

Cell Phone Use Affects Brain Metabolism

Volkow ND, Tomasi D, Wang GJ, et al. Effects of cell phone radiofrequency signal exposure on brain glucose metabolism. *JAMA* 2011;305:808–13.

Study Overview

Objective. To examine the effect of acute cellular telephone exposure on the brain.

Design. Randomized crossover study.

Setting and participants. The study examined 47 healthy participants from New York State’s Brookhaven National Laboratory between 1 January and 31 December 2009. Two cell phones were placed on participants, one on each ear. Two scans were performed: one with the right cell phone receiving a call with the sound muted for 50 minutes (“on” condition) and the second with both cell phones turned off (“off” condition). The brain glucose metabolism of each subject was measured using positron emission tomography with flurodeoxyglucose injection under resting conditions. The scans were randomly assigned and subjects were blinded to the intervention.

Main outcome measure. Brain glucose metabolism calculated as an absolute value and as a normalized (region compared with whole brain) value.

Main results. There were no detected differences in whole-brain metabolism between “on” and “off” conditions (41.7 $\mu\text{mol}/100$ g per minute [95% confidence interval (CI), 40.1–43.4] vs. 41.2 $\mu\text{mol}/100$ g per minute [95% CI, 39.5–42.8]). Brain glucose metabolism in the region closest to the cell-phone antenna was significantly higher for “on” compared to “off” conditions (35.7 vs. 33.3 $\mu\text{mol}/100$ g per minute; mean difference = 2.4 [95% CI, 0.67–4.2]; $P = 0.004$). Increased metabolism was significantly correlated with both absolute metabolism ($R = 0.95$, $P < 0.001$) and

normalized metabolism ($R = 0.89$; $P < 0.001$).

Conclusion. Cell phone exposure was correlated with increased metabolism in the region of the brain closest to the antenna; the clinical significance of this finding remains unknown.

Commentary

Cell phone use has exploded across the globe. There have been substantial concerns about the negative effects of radiofrequency-modulated electromagnetic fields (RF-EMFs), which are emitted by cell phones, on neuronal activity. Some studies have shown that these electromagnetic waves may be associated with higher risk of brain tumors [1], though the data have been less than convincing.

The study by Volkow et al offers several important findings. First, it demonstrates that cell phone exposure is associated with changes in brain glucose metabolism, suggesting that cell phone use may increase brain activity. The fact that the effects of cell phone exposure were greatest in the regions of the brain closest to the cell phone antenna during exposure is troubling and suggests that the metabolic increases may be secondary to the absorption of RM-EMFs by the brain. The increase in the activity was small (approximately 10%), and its clinical significance is not known.

There are important limitations to this study that affect its interpretability. First, this is a single study of a small number of individuals using 1 specific type of cell phone. Whether these impacts would be present with other cell phones or if patients were using headsets (in conjunction with their cell phones) is unclear. Whether

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the increased glucose metabolism is a precursor of the kinds of cellular activity that would be associated with higher rates of brain tumor or other untoward clinical effects is unknown.

Applications for Clinical Practice

Given that a large proportion of the world's population now uses cell phones, understanding whether they cause significant harm due to electromagnetic radiation is of major

public health importance. The paper by Volkow et al is a helpful first step to understanding the dangers, if any, of cell phone use and how we might mitigate them.

—Review by Ashish K. Jha, MD, MPH

References

1. Dubey RB, Hanmandlu M, Gupta SK. Risk of brain tumors from wireless phone use. *J Comput Assist Tomogr* 2010;34:799–807.

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